National Aeronautics and Space Administration

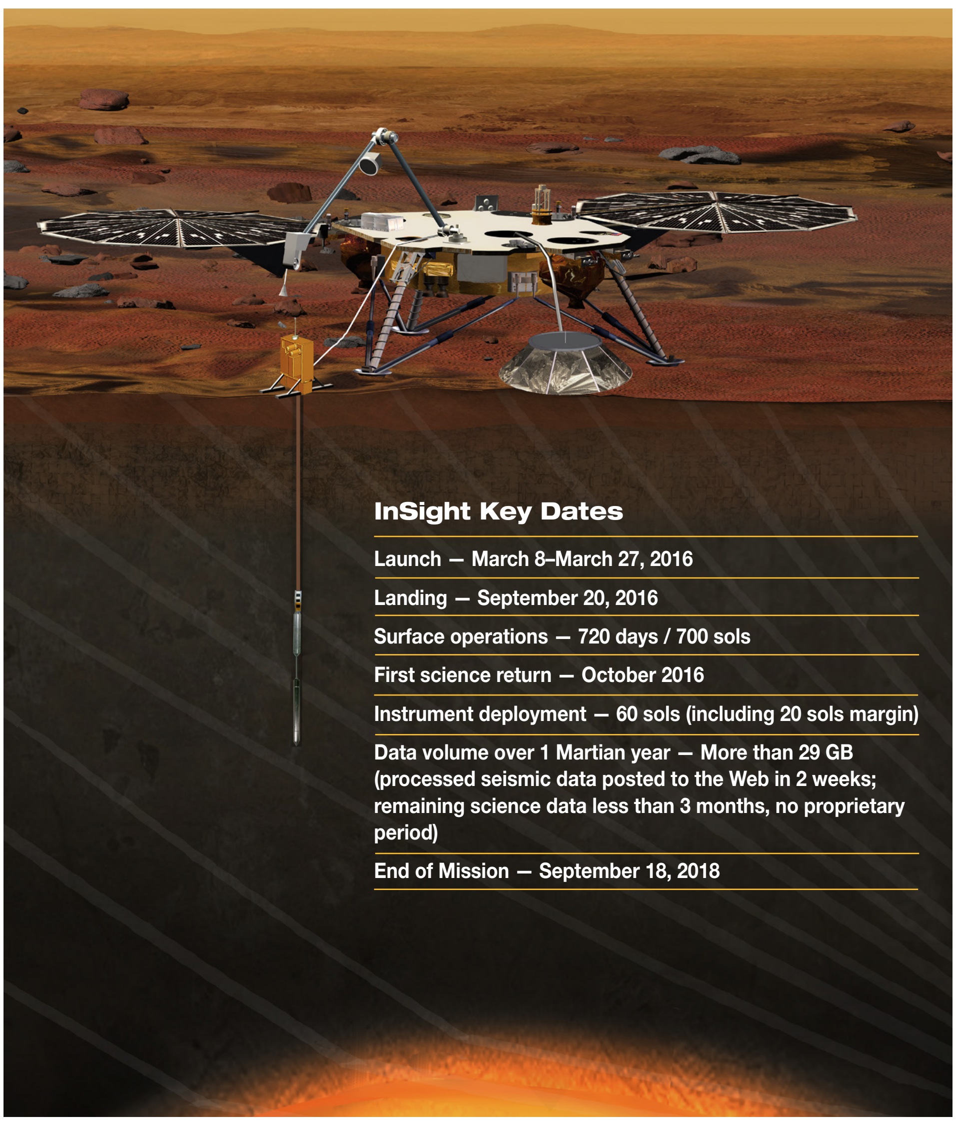
NASA facts

InSight

... into the Early Evolution of Terrestrial Planets

InSight (Interior exploration using Seismic Investigations, Geodesy and Heat Transport) is a NASA Discovery Program mission that would place a single geophysical lander on Mars to study its deep interior. But InSight is more than a Mars mission — it is a terrestrial planet explorer that would open a window into the processes that shaped the rocky planets of the inner solar system (including Earth) more than four billion years ago. By using sophisticated geophysical instruments, it would address fundamental questions about the formation of Earth-like planets by detecting the fingerprints of those processes buried deep within the interior of Mars.

The science payload comprises two instruments: the Seismic Experiment for Interior Structure (SEIS), provided by the French Space Agency (CNES), with the participation of the Institut de Physique du Globe de Paris (IPGP), the Swiss Federal Institute of Technology (ETH), the Max-Planck-Institute for Solar System Research (MPS), Imperial College and the Jet Propulsion Laboratory (JPL); and the Heat Flow



InSight is based on the proven Phoenix Mars spacecraft and lander design with state-of-the-art avionics from the Mars Reconnaissance Orbiter and Gravity Recovery and Interior Laboratory missions.

and Physical Properties Package (HP^3), provided by the German Space Agency (DLR). In addition, the Rotation and Interior Structure Experiment (RISE), led by JPL, would use the spacecraft communication system to provide precise measurements of planetary rotation. This instrumentation would be carried by the proven Phoenix Lander, built by Lockheed Martin Space Systems, providing low-cost, low-risk access to the surface of Mars.

Science Goals and Objectives

1. **Understand the formation and evolution of terrestrial planets through investigation of the interior structure and processes of Mars by:**

- Determining the size, composition and physical state (liquid/solid) of the core.
- Determining the thickness and structure of the crust.
- Determining the composition and structure of the mantle.
- Determining the thermal state of the interior.

2. **Determine the present level of tectonic activity and meteorite impact rate on Mars.**

- Measure the magnitude, rate and geographical distribution of internal seismic activity.
- Measure the rate of meteorite impacts on the surface.

Project Team

The InSight Principal Investigator (PI) is W. Bruce Banerdt of the Jet Propulsion Laboratory (JPL); the Deputy PI is Suzanne Smrekar (JPL). The Project Manager is Tom Hoffman and the Deputy Project Manager is Henry Stone. The SEIS PI is Philippe Lognonné (IPGP) and the HP^3 PI is Tilman Spohn (DLR). The international science team includes Co-Investigators from the United States, France, Germany, Austria, Belgium, Canada, Japan, Switzerland and the United Kingdom.

Mission Partners

InSight is managed by the Jet Propulsion Laboratory, California Institute of Technology. JPL is also responsible for science leadership, systems engineering, navigation, mission operations and the instrument deployment arm and camera.

Lockheed Martin Aerospace Corporation is responsible for spacecraft development, spacecraft assembly, integration and test, launch operations and mission operations support. CNES would manage, integrate and deliver the SEIS, and DLR would build and deliver HP^3.

The Structure of Terrestrial Planets

Terrestrial (rocky) planets all share similar structures, with chemically distinct crusts, mantles and cores. Although their bulk compositions are roughly the same as that of meteorites, the primitive building blocks of the solar system, their “construction” is far from uniform and none of the rocks found in them today are at all like meteorites. These bodies reached their current overall structure through the process of melting and differentiation, a process that is poorly understood.

During differentiation, the molten outer portions of the planet (sometimes called a “magma ocean”) cool and crystallize into various minerals, depending on the temperature, pressure and the chemical composition of the melt, all of which vary with time. Lighter minerals rise toward the surface to form the primary crust, while heavier minerals sink to form the mantle, and much of the iron and nickel form a metallic core at the center of the planet. Many of the fundamental characteristics that define the planets today, such as the composition of the surface rocks, the level of volcanic and tectonic activity, the composition of the atmosphere and the presence or absence of a magnetic field, depend on the details of how these processes acted in the first hundred million years after formation.

Studying Mars to Understand Planet Formation

It happens that Mars is in the “sweet spot” — big enough to have undergone most of the early processes that fundamentally shaped the terrestrial bodies (Mercury, Venus, Earth, Earth’s Moon and Mars), but small enough to have retained the signature of those processes for the next four billion years (unlike Earth). That signature is revealed in the basic structural building blocks of the planet: crust thickness and global layering, core size and density, and mantle density and stratification. The rate at which heat is escaping from the interior provides an additional valuable constraint.

InSight would address a fundamental issue of solar system science, not just specific questions about a single planet. By studying Mars, InSight would illuminate the earliest evolution of rocky planets, including Earth.

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

Follow us:

Web **http://insight.jpl.nasa.gov**

http://www.facebook.com/NASAInSight

https://twitter.com/#!/NASAInsight

JPL 400-1513, Rev. 2 1/13